

CLAIMS

1. A radio communication apparatus that carries out radio transmission by applying a multicarrier scheme to space multiplexing transmission, comprising:

5 a detection section that detects adaptability to space multiplexing transmission for each divided band obtained by dividing a communication band of multicarrier transmission and to which a plurality of subcarrier signals belong; and

10 a setting section that sets a transmission format used to carry out radio transmission based on the adaptability detected for said each divided band.

2. The radio communication apparatus according to claim 15 1, wherein said detection section detects adaptability including an average spatial spread of an arriving path of said plurality of subcarrier signals.

3. The radio communication apparatus according to claim 20 2, wherein said detection section comprises:

 a correlation calculation section that calculates a correlation value between a pilot signal embedded in said plurality of subcarrier signals and a replica of said pilot signal; and

25 an adaptability function calculation section that calculates adaptability for said each divided band based on the calculated correlation value.

4. The radio communication apparatus according to claim 3, wherein said detection section further comprises a generation section that generates a correlation matrix for said each divided band based on said correlation value, and said adaptability function calculation section calculates said adaptability using said correlation matrix.

5. The radio communication apparatus according to claim 4, wherein said generation section calculates a correlation matrix of a column vector corresponding to each of said plurality of subcarrier signals.

6. The radio communication apparatus according to claim 5, wherein said generation section obtains a correlation matrix for said each divided band by integrating the correlation matrix of said column vector.

7. The radio communication apparatus according to claim 4, wherein said generation section calculates said correlation matrix using the following equation:

$$R = \frac{1}{N_c} \sum_{n=1}^{N_c} V_n V_n^H \quad [\text{Equation 1}]$$

where R denotes a correlation matrix, N_c denotes a number of subcarrier signals belonging to a divided band, V_n denotes a column vector corresponding to nth subcarrier

signal belonging to a divided band, and H denotes a complex conjugate transposition operator

8. The radio communication apparatus according to claim
5 4, wherein said adaptability function calculation section obtains adaptability including a first function value and a second function value which is different from said first function value from an eigenvalue of said correlation matrix.

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9. The radio communication apparatus according to claim
8, wherein said first function value indicates reception
quality, said second function value indicates said
spatial spread, and said setting section sets said
15 transmission format according to a result of a comparison
between said spatial spread and a threshold which changes
in conjunction with said reception quality.

10. The radio communication apparatus according to claim
20 3, wherein said detection section further comprises a
generation section that generates a correlation vector
for said each divided band based on said correlation value,
and said adaptability function calculation section uses
said correlation vector to calculate said adaptability.

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11. The radio communication apparatus according to claim
10, wherein said generation section correlates a column

vector corresponding to each of said plurality of subcarrier signals and a predetermined element in said column vector.

5 12. The radio communication apparatus according to claim 11, wherein said generation section obtains said correlation vector by integrating said correlation result.

10 13. The radio communication apparatus according to claim 11, wherein said generation section calculates said correlation vector using the following equation:

$$z = \frac{1}{N_c} \sum_{n=1}^{N_c} V_{n,x}^* V_n \quad [\text{Equation 2}]$$

where z denotes a correlation vector, N_c denotes a number
15 of subcarrier signals belonging to a divided band, V_n denotes a column vector corresponding to nth subcarrier signal belonging to a divided band, V_{n,x} denotes a xth element in column vector V_n, x denotes a constant equal to or smaller than a number of reception antennas, and
20 * denotes a complex conjugate transposition operator

14. The radio communication apparatus according to claim 3, further comprising a path search section that detects a path timing using said pilot signals, wherein said
25 correlation calculation section calculates a correlation value for said detected path timing.

15. The radio communication apparatus according to claim
2, wherein said detection section punctures any one of
said plurality of subcarrier signals when detecting said
5 adaptability.

16. The radio communication apparatus according to claim
2, wherein said detection section changes a bandwidth
of said each divided band according to a spreading factor
10 in a frequency axis direction.

17. The radio communication apparatus according to claim
2, further comprising: a transmission section that
transmits a plurality of subcarrier signals which belong
15 to said communication band and in which pilot signals
are embedded to a communicating apparatus; and a reception
section that receives information acquired and replied
by said communicating apparatus using the pilot signals
embedded in the plurality of transmitted subcarrier
20 signals, wherein said detection section calculates
adaptability for said each divided band based on received
information.

18. The radio communication apparatus according to claim
25 17, wherein said detection section changes the bandwidth
for said each divided band according to a spreading factor
in a frequency axis direction.

19. The radio communication apparatus according to claim
2, wherein said setting section determines a space
multiplexing number of said communication band based on
5 adaptability detected for said each divided band.

20. The radio communication apparatus according to claim
2, wherein said setting section determines a space
multiplexing number for said each divided band based on
10 adaptability detected for said each divided band.

21. The radio communication apparatus according to claim
2, wherein said setting section sets said transmission
format as a transmission format for space multiplexing
15 transmission and further comprises a transmission section
that transmits a pilot signal when a transition occurs
from a mode in which said transmission format for space
multiplexing transmission is not used to a mode in which
said transmission format for space multiplexing
20 transmission is used.

22. The radio communication apparatus according to claim
2, wherein said setting section sets any one of a
transmission format including a known signal and a
25 transmission format not including said known signal.

23. The radio communication apparatus according to claim

2, further comprising an acquisition section that acquires an evaluation value on mobility of a communicating apparatus, wherein said setting section sets said transmission format based on an acquired
5 evaluation value.

24. The radio communication apparatus according to claim 2, wherein said detection section comprises:

a correlation calculation section that calculates
10 a correlation value between different branches in an array antenna used for space multiplexing transmission; and
an adaptability function calculation section that calculates adaptability for said each divided band based on a calculated correlation value.

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25. The radio communication apparatus according to claim 24, wherein said detection section further comprises a generation section that generates a correlation matrix for said each divided band based on said correlation value,
20 and said adaptability function calculation section calculates said adaptability using said correlation matrix.

26. The radio communication apparatus according to claim 25, wherein said adaptability function calculation section obtains adaptability including a first function value and a second function value which is different from

said first function value from an eigenvalue of said correlation matrix.

27. The radio communication apparatus according to claim
5 26, wherein said first function value indicates reception
quality, said second function value indicates said
spatial spread, and said setting section sets said
transmission format according to a result of a comparison
between said spatial spread and a threshold which changes
10 in conjunction with said reception quality.

28. The radio communication apparatus according to claim
24, wherein said detection section further comprises a
generation section that generates a correlation vector
15 for said each divided band based on said correlation value,
and said adaptability function calculation section uses
said correlation vector to calculate said adaptability.

29. A base station apparatus comprising the radio
20 communication apparatus according to claim 1.

30. A mobile station apparatus comprising the radio
communication apparatus according to claim 1.

25 31. A radio communication method for a radio communication
apparatus that carries out radio transmission by applying
a multicarrier scheme to space multiplexing transmission,

comprising the steps of:

detecting adaptability to space multiplexing transmission for each divided band obtained by dividing a communication band of multicarrier transmission and
5 to which a plurality of subcarrier signals belong; and

setting a transmission format used to carry out radio transmission based on the adaptability detected for said each divided band.